

Northeast Anaerobic Digester Accelerator — Food Waste Digestion Insights

The Center for EcoTechnology's (CET) Northeast Anaerobic Digester Accelerator (NADA) is a two-year project supported by EPA's Funding to Support Anaerobic Digestion in Communities. The NADA project includes development of resources and training documents for source separation and diversion of commercial and institutional food waste to digesters in the Northeast states. Among the resources created were a guidance outlining source separation practices to implement when diverting food waste to anaerobic digestion (AD), and this overview, Food Waste Digestion Insights, which discusses AD fundamentals, and provides examples of service providers — haulers and food waste preprocessing and digester facilities in the Northeast.



Fundamentals of Anaerobic Digestion

AD — the process of biological decomposition without the presence of oxygen — has been utilized to manage organic waste streams for centuries. The process yields biogas, which can be utilized to generate electricity or a renewable natural gas, as well as digestate, which can be utilized as a soil amendment.

AD is commonly used for treatment of wastewater solids, high strength organic wastes such as fats, oils and grease (FOG), meat processing residuals, and livestock manure. More recently, AD has been utilized to manage source separated food waste streams, either by themselves at a stand-alone AD facility, or in combination with livestock manure or biosolids, a process known as co-digestion. Co-digestion enables use of existing infrastructure, and adding food waste increases biogas yield without utilizing a significant amount of the digester's capacity.

Examples of these types of facilities are found in the Northeast states. A number of them have been developed to enable generators of food waste to comply with state disposal bans. The majority accept all types of food waste (vegetative, meat/fish/dairy, pre- and post-consumer streams, etc.), and rely on revenues from tipping fees and the increased production of biogas as profit centers, and to offset capital and operating costs related to co-digestion.

AD technologies fall into two basic categories: wet and dry. An easy distinction is that any feedstock going into a wet digester must be “pumpable”, whereas material going into a dry digester is “scoopable” using a front-end loader bucket. Currently, there are only wet digestion systems operating in the Northeast states. The region has several food waste-only facilities, including Quantum Biopower in Southington, CT; Rhode Island Bioenergy Facility in Johnston; Trenton Biogas in Trenton, NJ; and the new BioEnergy DevCo plant in Jessup, MD. The other types in the region are located on dairy farms or at wastewater treatment plants.

Food waste going into a wet AD system needs to be size reduced or slurried to make it pumpable. An increasingly common way to preprocess food waste is to run it through a depackaging unit. A depackager utilizes applied force (e.g., hammers, shears, extrusion) to produce a slurry, and to remove packaged foods from their containers and boxes. This equipment is located at the AD facility or at a food waste transfer station, which processes the food waste and then transports it by tanker truck to a digester. Other preprocessing options include food waste pulpers installed at commercial and institutional kitchens, and a garbage disposal-like system that discharges slurried food waste into a storage tank at the generator’s site.

Solution Provider Examples

To develop these resources for the NADA project, input was sought from AD facility operators, organics haulers, and food waste preprocessors about services provided, experience working with various types of generators and food waste, and recommended source separation practices. The business models vary (e.g., collection only vs. AD only) but other factors are consistent among the different operations. For example, digester operators interviewed have variable tip fee pricing, based on factors such as biogas potential of a feedstock (e.g., FOG has high biogas potential), longevity of the contract with the generator, quantity of material to be diverted, and whether the feedstock requires preprocessing or is a liquid feedstock from a single generator that is homogenous and consistent and can be unloaded directly into a storage tank that feeds the digester.

The descriptions below are only a sampling of the solution providers and their business models in the Northeast. Information was culled from interviews as well as BioCycle articles.

Hauler Only

- **Natural Upcycling**, a food waste/ organics collection company based in Linwood, New York, services states in the Northeast down to the District of Columbia. Customers include restaurants, grocery stores, hospitals, universities/schools, cafeterias, food manufacturers, and food distribution centers. Upwards of 100,000 tons per year of food waste are collected. About 75% is recycled via AD and about 25% is composted, fed to animals, or land applied. As a hauler, having food waste that is not contaminated or packaged provides more options for where the material can be taken for recycling.



Natural Upcycling's organics collection truck.

Collection, On-Site Preprocessing, and Anaerobic Digestion

- **Exeter Agri-Energy**, and its sister company, **Agri-Cycle**, are subsidiaries of **Stonyvale Farm** in Exeter, Maine, a dairy farm with 2,000 cows. Agri-Cycle provides organics collection throughout New England, servicing commercial and institutional generators. They accept packaged materials as well as source separated food waste. Collected organics are hauled to Stonyvale Farm where Exeter Agri-Energy utilizes a depackaging unit to separate out the packaging and contamination, and create a slurry, which is co-digested with dairy manure. The biogas is used to generate electricity, and the digestate is recycled for use as animal bedding and fertilizer. The depackaging capability at the digester lessens the requirement for source separation by the generators that Agri-Cycle services.



Feedstocks prior to depackaging at Exeter Agri-Energy facility.



Reinford Farms processes off-spec or out-of-date packaged food in a Scott Equipment Turbo Separator.

- **Reinford Farms** in Mifflintown, Pennsylvania operates an 800-head dairy farm. Its two digesters have capacity to co-digest 25,000 tons per year of food waste from clients such as distribution centers, cold storage warehouses, and food manufacturing facilities. The majority of food waste received is in packaging — much of it hauled to the farm by Reinford in its trailers that are parked at the generators' locations. It also utilizes a depackager, and generates electricity with the biogas produced. Digested solids are used to bed the dairy cows and the separated liquid is applied to cropland managed by Reinford.

Collection and Preprocessing

- **Waste Management (WM)** operates three CORE food waste preprocessing facilities (CORE is WM's proprietary food waste processing system) in the Northeast, located in Boston, New York City, and Elizabeth (NJ). Haulers, including WM, bring food waste to the CORE facilities where it is processed into an "engineered bioslurry" that is transported to wastewater treatment plants for co-digestion with biosolids. An example is the CORE facility in Boston, which processes residential and commercial food waste, and then hauls the bioslurry in tanker trucks to the Greater Lawrence Sanitary District (GLSD) in Andover (MA) where it is co-digested with wastewater solids. The biogas is used to generate electricity for the plant's operations; the digested solids are pelletized and recycled.



Greater Lawrence Sanitary District (GLSD) anaerobic digesters.



Food waste is unloaded into a hydrolyzer tank at Vermont farm digester in Vanguard Renewables' network.

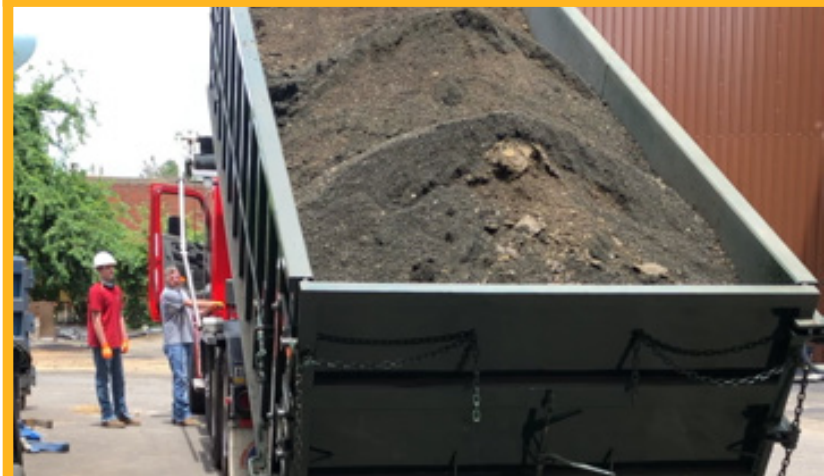
Off-Site Preprocessing, On-Site Anaerobic Digestion

- Vanguard Renewables**, a digester developer based in Wellesley, Massachusetts, builds, owns and operates anaerobic digesters on dairy farms in Massachusetts and Vermont that co-digest food waste supplied by Vanguard with the farm's manure. The dairies receive a lease payment and utilize free heat recovered from the engines that combust the biogas into electricity, as well as fertilizer and bedding material for the cows. In 2020, Vanguard opened a fully enclosed organics recycling facility in Agawam (MA) where it receives packaged and unpackaged food and beverage waste, which is processed in a depackager. The slurried food waste is hauled by tanker trucks to farms in Massachusetts and Vermont with Vanguard digesters. The farms in Massachusetts generate electricity from the biogas; the farm in Vermont produces renewable natural gas (RNG) that is injected into Vermont Gas System's pipeline.

On-Site Preprocessing and Anaerobic Digestion

A common configuration for AD facilities processing food waste on-site is to receive the feedstocks inside a building or enclosed area where it is tipped, inspected for obvious contamination, and then loaded into a depackager or a hopper that feeds a preprocessing line (including depackaging). Examples of facilities with this configuration include:

- Trenton Biogas** in Trenton (NJ), operated by Trenton Renewables, has capacity to process 400 tons per day of commercial, municipal, industrial, and agricultural food waste streams in the facility's digesters. Haulers unload directly into hoppers installed below the floor level. Food waste goes through crushers, screens, and magnets to prepare it for depackaging. After depackaging a refinement step separates out glass and other hard, dense material in the slurry before loading into the digesters. Biogas is used to generate electricity and heat; solids separated from the liquid digestate are cured and refined for use as soil amendments.



Incoming food waste (top) is unloaded onto a preprocessing line prior to anaerobic digestion. Separated solids (above) are used as soil amendments.

- BioEnergy DevCo's** new food waste AD facility in Jessup (MD) is co-located with the Maryland Food Center, one of the largest wholesale produce terminals on the East Coast. The plant has capacity to recycle 110,000 tons of organics annually to produce renewable natural gas (a fossil gas equivalent) for energy and 16,575 tons of soil amendment for agricultural and other land use. Feedstocks accepted include all types of food waste, FOG, and industrial food and beverage processing residuals. Liquid wastes are pumped directly into a storage tank. Solids are unloaded onto an enclosed tip floor and then pushed with a loader into a feeder pit that contains two large hoppers. The hoppers are equipped with triple augers that crush the feedstocks, including packaging, and move them to a depackaging unit. These organics are digested. After biogas conditioning, the renewable natural gas is injected into the Baltimore Gas & Electric pipeline.



BioEnergy DevCo's food waste digester under construction at the Maryland Food Center Authority in Jessup.



The Hermitage facility's depackager is equipped with a screw press.

- The City of Hermitage, Pennsylvania Municipal Authority** operates a Food Waste to Energy and Wastewater Reclamation Facility (WRF). The City of Hermitage's Organics Recovery Program at the WRF is operated as a complementary business that provides revenues and cost savings to support the Authority's core mission — water quality. About 75% of incoming food waste is preprocessed in one of three depackagers. The plant co-digests about 10,000 gallons per day of food waste — about 30% of its daily throughput. Revenues from tipping fees have averaged \$150,000 to \$200,000 per year. Hermitage is able to produce sufficient additional biogas via co-digestion for the facility to achieve energy neutrality (i.e., it runs the plant without any power from the grid). Digested biosolids (Class A) generated at the plant are land applied on nearby farms.

CET Resources For Anaerobic Digestion Solution Providers

The Center for EcoTechnology can assist AD solution providers by:

1. Training existing customers in proper source separation practices and/or developing educational materials for their customers to utilize.
2. Mapping specific food waste generators in anaerobic digester's service area.
3. Helping AD solution providers collaborate with local governments that want to initiate and/or expand food waste recycling programs.

Contamination Management

Anaerobic digesters processing food waste in the Northeast utilize a wet digestion process that is optimized when the food waste feedstock is free of contamination. Preprocessing equipment utilized to remove contamination in the food waste prior to AD may need to be supplemented by additional processing (e.g. passing through a finer mesh screen) to remove remaining small particles either before or after the AD phase.

Maximizing source separation at the source is the ideal solution for any organics recycling solution provider, including anaerobic digesters, composting facilities, and animal feeding operations. In practice, however, it is very challenging for generators in the grocery, restaurant, and food service sectors to avoid contamination. Therefore, the processors must configure their operations to address contamination realities. For AD facility operators, options to consider include:

1. Invest in preprocessing equipment and systems, which can be costly.
2. Narrow down feedstocks accepted to homogenous streams from food and beverage manufacturing, dairies, meat processing, etc.
3. Create specifications for incoming feedstocks (e.g., measurable limits on contaminants in incoming feedstocks) that may incentivize food waste generators to improve source separation practices, especially when having to comply with landfill disposal bans.
4. Employ tiered tipping fee rates that offer significant savings for clean food waste streams.

The Center for EcoTechnology acts as a catalyst to accelerate the development of a vibrant marketplace to divert wasted food from the commercial and institutional sectors. We believe that better managing wasted food is critical in order to address climate change, feed more hungry people, and grow our economy.

For more information, visit our Wasted Food Solutions website or contact us today.

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